

SYNTAX ZX80[®]

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REDESIGNED TELEPHONE DIALER

Last month we published a circuit and program for a ZX80 telephone dialer. Mike Barrett of West Branch, IA, called to tell us of some changes he made to our design. He eliminated the 7406 driver and increased the pull-up resistor to 2200 ohms. He also changed the 7475 latch to a 7476 flip-flop and eliminated the D0 line. He made a PC board of his new version and will send the schematic and PC board to SYNTAX readers for only \$3.00. Contact Mike at West Branch Mobile Home Village, #49, West Branch, IA, 52358, 319/643-2597.

MAIL ORDER BIG KEYBOARD

Now those of you who didn't have the time or confidence to wire your own big keyboard (Jan. 81) can have the convenience of a full sized typewriter keyboard for your ZX80 or MicroAce.

Southern California Optical offer big keyboards 3 ways. You can buy complete plans to wire your own for \$15, plans and all required parts for \$65 (including keyboard), or a pre-wired keyboard for \$85 (plus shipping for all prices). According to Leonard Holmberg, general manager, you can install the pre-wired keyboard in 5 minutes. Contact Holmberg at:
Southern California Optical
P.O. Box 6273
Orange, CA 92667
714/630-2130

Send us news of your inventions.

NEW PRODUCT UPDATES

Sinclair is manufacturing and delivering 16K RAMs in Europe in large quantities and ROMs may go into volume production within days, although first units will go to European customers. According to Nigel Searle of Sinclair, North American customers can expect to get RAMs sometime in March. "It could be that we'll have RAMs and ROMs as early as the first week in March," said Searle, but he made no promises about the quantity he would receive.

Searle also said the printer we mentioned in February is definite. It will be featured in advertisements in Europe in the next few weeks. We will report on the printer's features when we have details.

Don Stoner wrote to report on Microperipheral's modem. He said they've run into problems with the design and cost containment. They're trying another approach and getting additional information from Sinclair UK. He promised to let us know the outcome within 30 days or so. More news next month.

We listed CAI Instruments' printer and widget prices incorrectly last month. Printer (28 columns) is \$99.95, widget is \$49.95, and both together are \$139.95. CAI will start shipping in about 3-4 weeks.

Other producers still await the arrival of the ROMs and RAMs from England.

Syntactic Sum is a trademark of Syntax ZX80, Inc.

SYNS OF OMISSION

FEB. 81—Francis LeBaron, author of Addition Through 7 Digits, called to tell us he had left out a line. Insert: 225 LET FL=1 This change puts zeros inside numbers. Also, line 140 should read LET Y(I+1)=Y(I+1)+1. New Syntactic Sum=-27631.

The picture of line 2 in Son of Big Characters is incorrect. The eighth character should be **F**. The decimal listing is correct. Line 110 of that program should read 110 PRINT CHR\$(PEEK(16427+(Q AND B))....We omitted the third open parentheses mark. The Syntactic Sum is correct.

In the Computer Number Systems story, p. 10, 24 equals 2×10^1 plus 4×10^0 .

The Syntactic Sum for Multiplication Exercise should be -5117.

SINCLAIR-MICROACE LEGAL DISPUTE

Sinclair Research and Compshop, Ltd., (MicroAce's English parent company) may go to court in England over their license agreement. According to Nigel Searle of Sinclair, Compshop has violated the terms of their agreement. Andy Fisher of MicroAce denies Sinclair's charges. No word yet on the outcome and possible impact on Sinclair and MicroAce customers.

After our beginner's column on REM statements (Feb. 81), David Ornstein of Sinclair called to add some information. First, he says, REM statements with copyright notices do, in fact, constitute legal protection for your programs. (See story p. 9 about copyrights.) Second, a blank REM statement (a REM with nothing after it) causes the machine to skip the next line. This can be a useful tool for debugging a program, but avoid it otherwise.

BUILD ADDITIONAL RAM

Here's how to upgrade your computer's memory to 8K. Note: This is not a beginner's project. To avoid frustration, make sure you wire everything carefully.

Expand your memory by using 2114-L2 low-power, fast, 250 ns static memory chips—the same type used in the computer. The 2114 is organized as 1K by 4 bits. Thus, 2 chips form a memory as 1K by 8 bits (1K bytes). You'll need 16 chips for 8K bytes. With 10 address lines (A0-A9), you can program the 2114 to store and

OUR POLICY ON CONTRIBUTED MATERIAL

SYNTAX ZX80 invites you to express opinions related to the ZX80 and the newsletter. We will print, as space allows, letters discussing items of general interest. Of course, we reserve the right to edit letters to a suitable length and to refuse publication of any material.

We welcome program listings for all levels of expertise. Programs can be for any fun or useful purpose. We will test run each one before publishing it, but we will not debug programs: please send only workable listings.

In return for your listing, we will pay you a token fee of \$2.00 per program we use. This payment gives us the nonexclusive right to use that program in any form, world-wide. This means you can still use it, sell it, or give it away, and so can we.

We will consider submissions of news and hardware or software reviews. Please keep articles short (350-400 words). Again, we reserve the right to edit accepted articles to a suitable length. We will pay 7 cents per 6 characters, including spaces and punctuation, for accepted articles.

When you send in programs for possible publication in SYNTAX, please include the following information:

- How to operate the program, including what to input if it does not contain prompts.
- Whether you can run the program over again and how.
- How to exit the program.
- The Syntactic Sum (using the Syntactic Sum program in the February, 1981, issue).
- Whether it fits in 1K or 2K RAM (or 16K when available).

We pay for this explanatory text at the same rate as for articles in addition to payment for the program itself.

If you want us to return your original program listing or article, please include a self-addressed, stamped envelope. Otherwise, we cannot return submitted material.

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access all 1024 4-bit locations. A chip select (CS) chooses banks of memory or individual chips.

Figure 1 shows 2 of the array of memory chips. U1A and U1B are on the computer (U2A and U2B are on the 2K MicroAce). Bring the chip select line for these chips to the edge connector from pin 2A. All chips share the address lines A0-A9. Chips marked "A" share 1/2 of the data bus (D7, D0, D1, D2); those marked "B" share the other 1/2, as shown in Figure 2.

Figure 3 shows the decoding circuit, a 74155 3-8 decoder to decode address lines A11, A12 and A13 and select 2 of 16 RAM chips (or 1K) of 8K memory for a given address. ****IMPORTANT: The next step modifies your computer.**** Bring the RAM signal out to the edge connector from the computer by removing R19, a 2.2K ohm resistor (MicroAce R16). Edge connector pin 23B is unassigned, so assign the RAM signal to it. Connect 23B to pin 8 of U12 (MicroAce pin 11 of U22), using 30 gauge wire wrap wire.

Bus the address and data lines just as they are in the computer, as in Figure 2. Use a 47 nF capacitor (not shown) at each chip between +5V and 0V to decouple the power supply. Your extra memory requires its own 5V power supply. If you use low-power chips, the entire circuit draws about 500 mA.

Note: 1K MicroAces have space for 2 more memory chips to expand to 2K on board. To use these sites for 8K expansion, bring out a separate chip select line (CS2) to the decoder and remove U17.

Here's a memory test program:

```

10 FOR I=192 TO 8000
20 LET A=16384+I
30 POKE A,0
40 IF NOT PEEK(A)=0 THEN PRINT
"ERROR AT";A
50 POKE A,255
60 IF NOT PEEK(A)=255 THEN PRI
NT "ERROR AT";A

```

70 NEXT I
80 STOP
Syntactic Sum=9783

Alger Salt, Greenville, NC

Note: We built a 3K version of this memory.—KO

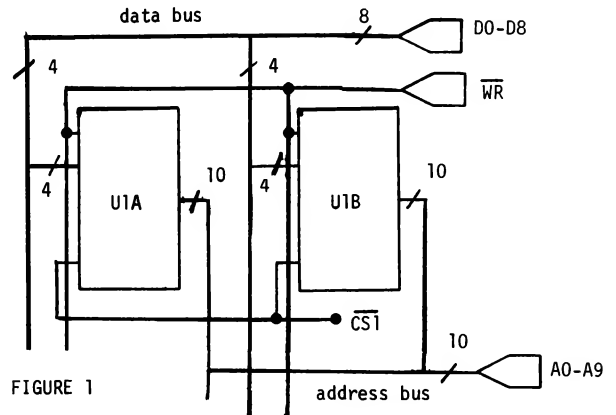


FIGURE 1

Bus address & data lines, power, ground, WR
Wire CS in pairs to decoder

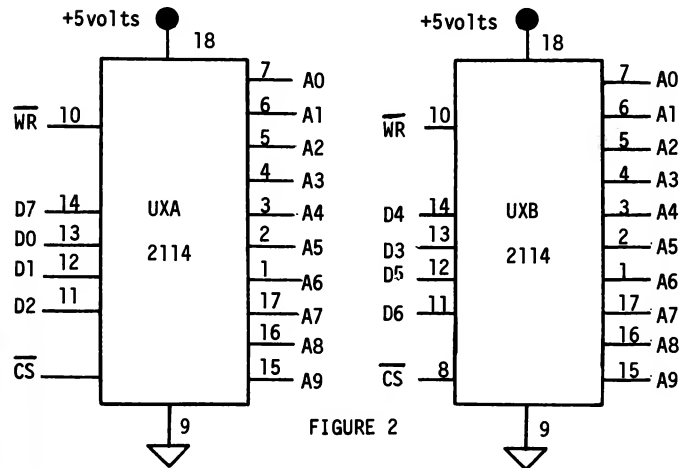


FIGURE 2

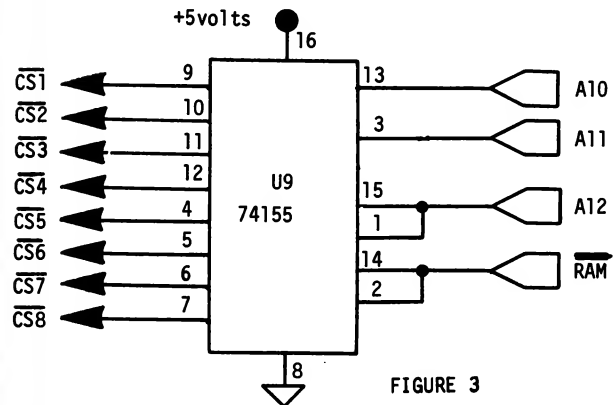


FIGURE 3

ESTIMATE HEATING COSTS

Use these 3 programs to estimate heating costs for houses and other small buildings. They are written in integer BASIC and so have limited accuracy. Use them for making comparisons.

Each one uses 1K of RAM to its fullest; some of the CLS statements are necessary to stay within the available display file.

In the R Value program, the resistance (R) values in lines 22-26 and 122-126 include the inside and outside air film resistance to heat flow. These values are typical for the materials in the program, but may vary slightly depending on the specific materials and thickness in your house. If you don't know the ceiling insulation thickness, use 3" for older houses and 4-6" for newer.

In the Heat Loss program, individual values in line 304 are in BTUs/hr; the total loss in line 310 is in BTUs/day. Input building measurements in feet or square feet. Use a daily average degree days value. (Degree days=65 - outside temperature.) If you know monthly averages, divide by the number of days in the month. Divide seasonal data by 150. The program assumes no heat loss through the floor and that the attic above is at the outside temperature. You may have to divide a larger building into 2 or more pieces to avoid an arithmetic overflow.

The Fuel Cost program assumes these heat values and conversion efficiencies:

*Fuel oil: 130,000 BTU/gal., 70% efficient
*Natural gas: 1,000,000 BTU/1000 cubic feet, 70% efficient
*Electricity: 3412 BTU/Kw hr., 100% efficient
*Coal: 10,500 BTU/lb or 21,000,000 BTU/ton, 70% efficient
*Wood: 6000 BTU/lb (25% moisture)

or 19,200,000 BTU/cord (3200 lb/cord), 65% efficient
Coal and wood values are averages and may differ from actual values. If you know more accurate values, proportion the constants in lines 190 and 200. Also, manufactured gas may differ in heat value from natural gas; change the constant in line 170 to adjust.

Andrew R. Banta, Bethlehem, PA

Note: You can save a few bytes in the R Value program by changing the LET-GO TO statement sequences to IF-THEN LET statements. For example, substitute IF I=1 THEN LET R=104 for lines 16-23.—AZ

R VALUE

```
10 PRINT "INSIDE WALL MATERIAL
? PLASTER=1 WALLBOARD=2 PANELING
=3"
15 INPUT I
16 GO TO 20+I*2
22 LET R=104
23 GO TO 30
24 LET R=119
25 GO TO 30
26 LET R=94
27 CLS
30 GO SUB 530
60 PRINT "OUTSIDE SHEATHING? W
OOD=1 FIBER =2"
65 INPUT I
66 CLS
67 GO TO 70+I*2
72 LET R=R+100
73 GO TO 80
74 LET R=R+200
80 PRINT "OUTSIDE SURFACE? ALU
MINUM SIDING UNINSULATED=1 ALUMI
NUM SIDING INSULATED=2 WOOD OR S
HINGLES=3 BRICK=4 STONE=5"
85 INPUT I
86 GO TO 90+I*2
92 GO TO 105
94 LET R=R+125
95 GO TO 105
96 LET R=R+80
97 GO TO 105
98 LET R=R+40
99 GO TO 105
```

```

100 LET R=R+100
105 LET RW=R/100
106 CLS
110 PRINT "CEILING MATERIAL? P
LASTER=1 WALLBOARD=2 ACOUSTIC
TILE=3"
115 INPUT I
116 GO TO 120+I*2
122 LET R=142
123 GO TO 130
124 LET R=157
125 GO TO 130
126 LET R=247
130 GO SUB 530
140 LET RC=R/100
145 CLS
150 PRINT "R VALUE WALLS=";RW,,
,"R VALUE CEILING=";RC
160 STOP
530 PRINT "INSULATION? FIBERGLA
SS/ROCKWOOL=1 CELLULOSE=2"
535 INPUT I
536 CLS
540 PRINT "INSULATION THICKNESS
?"
545 INPUT T
546 GO TO 550+I*2
552 LET R=R+370*T
553 GO TO 560
554 LET R=R+400*T
560 RETURN
Syntactic Sum=-9782

```

HEAT LOSS

```

10 PRINT "R FOR WALLS?"
20 INPUT RW
30 PRINT "R FOR CEILING?"
40 INPUT RC
50 PRINT "HOUSE PERIMETER?"
60 INPUT L
65 PRINT "CEILING AREA?"
66 INPUT AC
67 PRINT "CEILING HEIGHT?"
68 INPUT CH
70 PRINT "NUMBER OF STORIES?"
80 INPUT NS
90 PRINT "HOW MANY WINDOW SIZE
S?"
100 INPUT JMAX
105 LET P=0
106 LET WA=0
107 CLS
110 FOR J=1 TO JMAX
111 PRINT "WINDOW HEIGHT?"

```

```

112 INPUT HW
113 PRINT "WINDOW WIDTH?"
114 INPUT WW
115 PRINT "HOW MANY THIS SIZE?"
116 INPUT NW
117 LET P=(2*HW+2*WW)*NW+P
118 LET WA=HW*WW*NW+WA
120 CLS
121 NEXT J
130 PRINT "STORM WINDOWS? NO=1
YES=2"
140 INPUT SW
150 CLS
200 PRINT "HOW MANY DEGREE DAYS
?"
210 INPUT DD
220 LET AW=L*NS*CH-WA
250 LET BTUW=(AW/RW)*DD
260 LET BTUC=(AC/RC)*DD
270 LET BTUWD=(WA*DD)/SW
280 LET BTUI=(P*DD/2)/SW
300 LET BTU=(BTUW/100+BTUC/100+
BTUWD/100+BTUI/100)*24
303 LET BTUWI=BTUWD+BTUI
304 PRINT "WALL LOSS=";BTUW,,,"
CEILING LOSS=";BTUC,, "WINDOW LOS
S=";BTUWI
310 PRINT "HEAT LOSS/DAY=";BTU;
"00 BTUS"
999 STOP
Syntactic Sum=-11400

```

FUEL COST

```

10 PRINT "FUEL OIL COST IN CEN
TS/GAL?"
20 INPUT FOC
30 PRINT "NATURAL GAS COST IN
CENTS/1000 CUBIC FT?"
40 INPUT NGC
50 PRINT "ELECTRIC COST IN MIL
S/KWH?"
60 INPUT EC
70 PRINT "COAL COST IN $/TON?"
80 INPUT CC
90 PRINT "WOOD COST IN $/CORD?
"
100 INPUT WC
110 CLS
120 PRINT "WHAT IS HEAT LOSS IN
1000S OF BTUS/DAY?"
130 INPUT BTU
150 LET FOH=(BTU/91)*FOC
160 LET NGC=NGC/10
170 LET NGH=(BTU/70)*NGC

```

```

180 LET EH=(BTU/34)*EC
190 LET CH=(BTU/147)*CC
200 LET WH=(BTU/125)*WC
300 LET COST=FOH
310 PRINT "FUEL OIL COST=";
320 GO SUB 500
330 LET COST=NGH
340 PRINT "NATURAL GAS COST=";
350 GO SUB 500
360 LET COST=EH
370 PRINT "ELECTRIC COST=";
380 GO SUB 500
390 LET COST=CH
400 PRINT "COAL COST=";
410 GO SUB 500
420 LET COST=WH
430 PRINT "WOOD COST=";
440 GO SUB 500
450 STOP
500 LET DOL=COST/100
510 LET CEN=COST-DOL*100
515 IF CEN<10 THEN GO TO 530
520 PRINT "$";DOL;". ";CEN
525 RETURN
530 PRINT "$";DOL;". 0";CEN
535 RETURN

```

Syntactic Sum=-15980

MAZO-O-GRAPHIX

Enter this 2-line program:

```

10 PRINT CHR$(1+RND(2));
20 GO TO 10

```

Press RUN (NL) to create maze games. Players vie for fastest transit times top to bottom (easy) and side to side (harder). Or give each player 20 seconds to record how many N-S and E-W paths he finds. High bidder must prove his claim. If he cannot, the challenger gets the points. If he succeeds, he gets double points. Hit RUN (NL) to replay.

Otis Imboden, Washington, DC

To figure bytes used by part of a program, count the keystrokes to enter it, excluding NEWLINE and line numbers that start lines. Add 3 bytes for each line number, regardless of number of digits.

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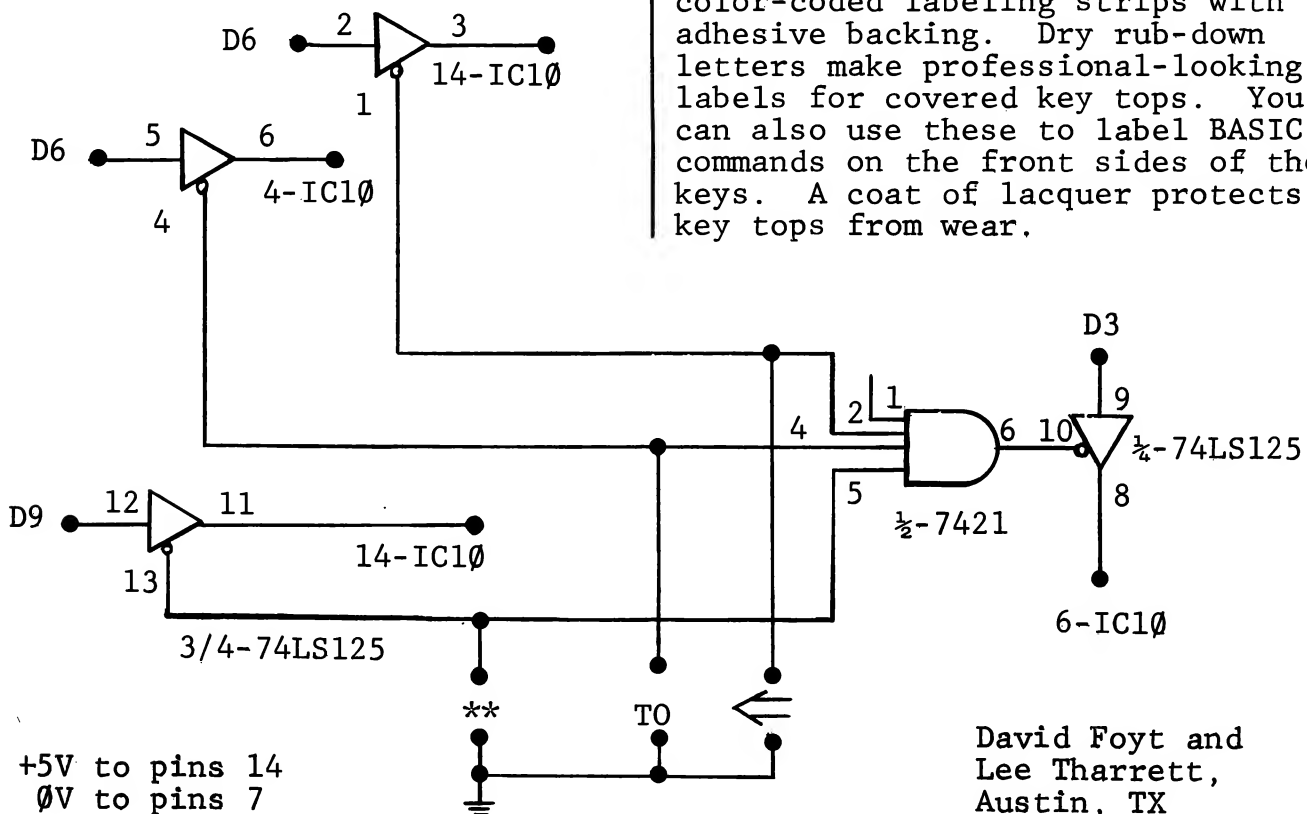
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David Foyt and
Lee Tharrett,
Austin, TX

USING EXTRA KEYS ON BIG KEYBOARD

The Dec., 80, issue of SYNTAX described how to wire a big keyboard onto your ZX80 or MicroAce. Some keyboards have up to 20 more keys than you need. You can wire these extra keys in parallel with existing keys to access shifted functions without pressing the SHIFT key.

If you have double pole keyswitches, just wire an existing key in parallel with 1 pole pair of pins on each extra key and wire SHIFT to the other pair.

With single pole keyswitches, use ICs to implement the permanently shifted keys. The circuit following shows three wired keys. To connect more, just use more 125's and connect pin 8 of the 7421 to pin 1. Keep adding AND chips until you wire all the keys you need; we have wired 16 permanently shifted keys this way.

To relabel your new keys, use color-coded labeling strips with adhesive backing. Dry rub-down letters make professional-looking labels for covered key tops. You can also use these to label BASIC commands on the front sides of the keys. A coat of lacquer protects key tops from wear.

DEAR EDITOR:

What purpose does Syntactic Sum serve? If you can't type NEW without deleting it, how do you replace a lengthy program? Line by line?

Gene Hammond, Carmel, CA

We wrote Syntactic Sum to help avoid typing errors when programs are transcribed repeatedly. Some of you have commented unfavorably on program errors in SYNTAX. We understand your frustration; we suffer the same frustration in trying to print perfect programs. Syntactic Sum will help both of us by providing a quick check for typing errors. To replace a lengthy program, just load a new one from tape.--AZ

Readers who constructed the eavesdropper circuit may have noticed annoying hash lines on their TV screens when monitoring their tape recorders. I found that even though the metal experimenter's box shields the circuit, the earphone itself and its cord cause interference. Unplugging the earphone from the circuit box solves the problem. Other objects seem to cause interference for my ZX80 and Sampo TV, including my paper hole puncher, a metal file box, and a stack of cassette tapes.

Colin Alexander, San Francisco, CA

To reduce eavesdropper (Dec., 80) interference, you can also wire a 10 nF ceramic disk capacitor across the earphone leads at the resistor end. The capacitor provides a path for high frequencies inside the box so they don't cause interference.--AZ

No parts layout information or schematics were supplied with my ZX80. It would be helpful if

you would include this information in future issues of SYNTAX.

Joe Whiteman, Culver City, CA

To get a free ZX80 schematic, write Sinclair Research at 50 Staniford St., Boston, MA, 02114. Request the 4 page technical manual, which includes the schematic and instructions for a direct video monitor.--AZ

In previous issues you listed vendors of existing and planned peripherals but neglected to publish addresses. Don't be a namedropper, how about addresses also?

Mel Routt, Safety Harbor, FL

Here are the addresses of companies mentioned in SYNTAX:

Innovision—D. Thornburg, Pres.
P.O. Box 1317
Los Altos, CA 94022

Voicetek—C. Georgiou, Pres.
P.O. Box 388
Goleta, CA 93017

Herbach & Rademan, Inc.
401 E. Erie Ave.
Philadelphia, PA 19134

Interface Technology
P.O. Box 383
Des Plaines, IL 60017

I found 2 programs requiring 8K ROM in your January issue. It also indicates Sinclair is currently unable to offer the 8K ROM. Is the 8K ROM available from another source? If not, why are you providing ZX80 owners with programs we are unable to use?

Eugene A. Cozzi, Barre, VT

No, the 8K ROM is not available from another source. We wrote the 8K ROM programs in December for

the January issue while we had an 8K ROM prototype. We were told by Sinclair that you would be able to get 8K ROMs around the first of the year. Thus we gave you programs to use your new ROMs right away. To bring you the latest news each month, we consult our sources just before press time, when we found out the ROM was delayed.

These SYNTAX readers would like to hear from others in their areas. If you want to contact ZX80 or MicroAce users in your area, send us your name, address, and phone number. We'll publish your request in the letters section when space permits.—AZ
*Amos Fegley, 365 Reo Ct., Warren, OH, 44483, 216/394-8356.
*Robert Samberg, 1741 Pilgrim Ave., Bronx, NY, 10461, 212/597-8609.
*Andrew Convery, Washington, DC, area, 703/620-9310.

Last December Congress passed the Computer Software Act of 1980 to protect the rights of people and companies who write, develop, sell, or lease software. The Feb. 81 issue of Output magazine says, "The new software act gives the owner or developer the exclusive right to copy a program or transfer rights to it...as soon as they (programs) are put into any tangible medium of expression such as a cassette, disk, or instruction manual. Fines, civil damages, or criminal penalties apply to piracy of copyrighted programs just as to any other copyrighted published material."

COMPUTER NUMBER SYSTEMS II

Last month we looked at binary numbers, the number system your computer actually thinks in. Now we'll look at the hexadecimal, or base 16, system.

The hexadecimal system has 16 digits, 0-F. Because our decimal,

or base 10, system has only 10 digits, we use letters A-F to represent digits after 9. Thus you count in hex: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. So $A_{16}=10_{10}$ and $F_{16}=15_{10}$.

In decimal, each digit represents a power of 10. For example, 209 is equivalent to 2×10^2 (or 200) plus 0×10^1 (or 0) plus 9×10^0 (or 9—remember, any number to the zero power equals 1). Similarly, in hex each digit represents a power of 16. So 7FEA equals 7×16^3 plus $F \times 16^2$ plus $E \times 16^1$ plus $A \times 16^0$, or 32746 in decimal.

So what? The handy thing about hex numbers is that they convert easily with binary, the number system digital computers use, because hex place values are also powers of 2. You can use a single unique hex character to represent any possible combination of 1 and 0 in 4 binary bits. This gives you shorter addresses than in decimal. (Addresses are data location in memory, identified by a number in hex or decimal.) So decoding hex numbers in a binary computer is simple, requiring less memory than to convert decimal numbers to binary.

These 2 programs, written by Bill Herron of San Diego, convert decimal numbers to hex and vice versa. Notice the range of numbers you can use is limited because the ZX80 can only handle numbers that fit in 2 bytes in its arithmetic register. The largest number you can put in 2 bytes is 256×256 or 65536. To use both positive and negative numbers, divide this number by 2 (half each on either side of zero).

DECIMAL TO HEX

```
1 REM DECIMAL TO HEX
10 DIM H(15)
12 FOR I=0 TO 15
14 LET H(I)=I+28
16 NEXT I
100 PRINT "D=";
```

```

110 INPUT D
120 PRINT D
300 PRINT "HX=";
320 PRINT CHR$(H((D AND -4096)/
4096-(D<0)*16));CHR$(H((D AND 38
40)/256));CHR$(H((D AND 240)/16)
);CHR$(H(D AND 15))
1000 INPUT Z$
1050 IF Z$="" THEN GO TO 100
Syntactic Sum= 20037

```

Range: -32768≤D≤32767
0≤HX≤8FFF16

HEX TO DECIMAL

```

100 REM HX TO DEC
106 DIM X(6)
110 LET X(0)=1
111 LET X(1)=16
112 LET X(2)=256
113 LET X(3)=96
114 LET X(4)=536
115 LET X(5)=576
116 LET X(6)=216
120 DIM Y(6)
123 LET Y(3)=4
124 LET Y(4)=65
125 LET Y(5)=48
126 LET Y(6)=777
130 DIM Z(6)
135 LET Z(5)=1
136 LET Z(6)=16
140 LET A=1000
150 DIM H(6)
200 PRINT "HX=";
220 INPUT H$
230 LET F=0
240 FOR I=0 TO 6
250 LET H=CODE(H$)
251 IF H=1 THEN GO TO 280
252 IF H>28 AND H<44 THEN LET F
=1
254 IF H>27 AND H<44 AND F>0 TH
EN GO TO 260
256 LET H$=TL$(H$)
258 GO TO 250
260 LET H(I)=H-28
265 PRINT CHR$(H);
270 LET H$=TL$(H$)
275 NEXT I
280 LET S=I-1
290 IF S<0 THEN GO TO 293
291 PRINT
292 GO TO 300
293 LET S=0

```

```

294 PRINT S
300 LET U=0
302 LET M=0
304 LET L=0
320 FOR I=0 TO S
330 LET X=X(S-I)*H(I)
332 LET Y=Y(S-I)*H(I)
334 LET Z=Z(S-I)*H(I)
340 LET L=L+X
342 LET C=L/A
344 LET L=L-C*A
350 LET M=M+Y+C
352 LET C=M/A
354 LET M=M-C*A
360 LET U=U+Z+C
370 NEXT I
400 PRINT "DEC=";
410 IF U>0 THEN GO TO 414
411 IF M>0 THEN GO TO 416
412 PRINT L
413 GO TO 450
414 PRINT U;
415 GO TO 420
416 PRINT M;
417 GO TO 430
420 PRINT TL$(STR$(M+A));
430 PRINT TL$(STR$(L+A))
450 CLEAR
Syntactic Sum= 10587

```

Range: 016≤HX≤FFFFFFF16
0≤D≤(228-1)=268435455

THE BEGINNER LEARNS TO LOAD

I finally got tired of typing in every program I wanted to run. Retyping all those programs over again had to be harder than learning how to save them on tape. Here's a run-down of some of the things I learned about saving and loading that might help you.

Using the SYNTAX cassette eavesdropper (Dec. 80) avoided that loud buzzing noise, reducing it to a quiet buzz audible only through the earphone. Try it out. Your family or roommates will appreciate it.

Being economy-minded, I saved as many programs as possible on one tape and used the rewind and fast forward to locate them. After I saved several programs and

Learn how to use a computer for \$249. And keep the computer.

Introducing the Computer Learning Lab, with the Sinclair ZX80 personal computer.

The Sinclair ZX80 is a powerful, personal computer already in use in tens of thousands of homes and businesses.

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100 LESSONS MAKE LEARNING EASY.

You just take the ZX80 out of the box, connect it to your TV and an ordinary cassette recorder (connectors are provided), and slip in the pre-programmed Learning Lab cassettes. There's nothing extra to purchase.

You'll be working with the computer your very first day!

The cassettes take you through 100

experiments that teach you how to solve problems with the ZX80.

You learn by doing. By actually working with the computer.

And the lessons are designed to be fun and involving. You create your own programs for games, code breaking, interest calculation, and other topics. Then you can apply the principles you've learned to more complex problems.

In fact, you'll be a master of the ZX80. To use in your business, for home budgeting, or just for fun.

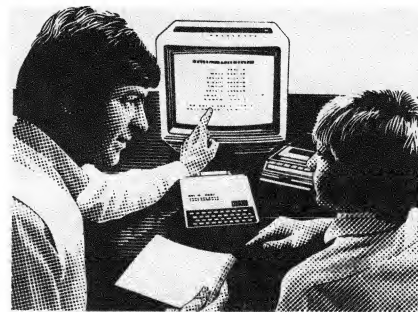
We'll also send you a catalog full of ready-to-use programs—from Loan Amortization to Lunar Lander—available for as little as \$6.95.

THE ADVANCED DESIGN OF THE ZX80.

The ZX80 is the world's first truly portable computer. It features a touch-sensitive keyboard and a 32-character by 24-line display.

And it performs like a much larger and more expensive computer. Single keystroke entries make typing programs fast and easy. An automatic error detection feature tells you if you

make mistakes. And program editing helps you correct them. Yet the complete Computer Learning Lab, including computer, is still several hundred



The Computer Learning Lab is a family learning aid. Children 10 and above will quickly understand the principles of computing—and have fun learning.

dollars less expensive than any comparable computer alone.

The ZX80 is backed by a 30-day money-back guarantee and a 90-day limited warranty with a national service-by-mail facility. Extended service contracts for the ZX80 are available for a minimal charge.



The complete package includes the ZX80, a 128-page guide to computing, a workbook, six program cassettes, and two blank cassettes for storing your own programs.

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Please send me _____ Computer Learning Lab(s) with the ZX80 personal computer at \$249 each (U.S. dollars).

Please send me _____ ZX80 computer(s) only, without the Learning Lab, at \$199.95* each.

I enclose check/money order payable to Sinclair Research Ltd. for \$_____ (Add \$5.00 for shipping.)

*For Conn. deliveries, add sales tax.

Name _____

Address _____

City _____ State _____ Zip _____

Occupation _____ Age _____

Intended use of ZX80: _____ SA-1-1

Have you ever used a computer? Yes No Do you own another personal computer? Yes No

couldn't get them to load, I found out that rewinding and stopping the tape in the middle of a saved program puts glitches in the program. Then it won't load correctly. Moral: Use short tapes instead of the 90 minute kind and put only a couple on each side. Always rewind to the beginning and let it play through to the program you want.

As I merrily typed in programs and saved them, I found to my chagrin that one especially long one wouldn't reload and I had already cleared the screen. Second moral: Record each program at least twice before you clear it by loading or hitting NEW to make sure you get at least 1 good save.

Then someone took my eavesdropper away to make an adjustment and I couldn't stand the buzzing noise so I turned down the volume. This really screwed up the saving and loading. Third moral: Volume is critical. Leave the setting at full, treble up, bass down.

I also found that recording a voice title ahead of each program could cause problems. Inserting and removing the jacks repeatedly gives a greater chance of putting them in wrong or making a loose connection. To avoid this, record

2 copies of only 1 or 2 programs on each side, and label the tape with the names and order. If you must use a voice announcement, use an external mike (the hand-held kind).

Jim Holder wrote to say he solved his loading problems by switching to a better quality audio tape. He now uses Radio Shack Supertape or equivalent. He also uses a subdued background noise recorded with the voice to easily identify the silent period.

So here's my almost fool-proof saving and loading process: To save, press SAVE, then start the recorder. Wait for the buzz to come to full volume. Press NL. After the program comes back on the screen, record several seconds of buzz, then stop the recorder. To load, press LOAD, then start the recorder. Listen for the quiet period, then press NL. Wait to hear the buzz again before stopping the recorder. Then rewind the tape. Never turn the recorder on or off during the quiet period or the program supercharged buzz.

Also keep in mind suggestions from SYNTAX readers to avoid interference by using a non-metal table and keeping the computer away from the TV radiation.

SYNTAX

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